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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/538,763	06/10/2005	Steven Douglas Slonaker	3911/27955	5550

25570 7590 12/03/2010
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EXAMINER	
GEBRESILASSIE, KIBROM K	

ART UNIT	PAPER NUMBER
2128	

NOTIFICATION DATE	DELIVERY MODE
12/03/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/538,763	SLONAKER, STEVEN DOUGLAS	
	Examiner	Art Unit	
	KIBROM GEBRESILASSIE	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 September 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-49* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *16-20 and 30-41* is/are allowed.

6)☒ Claim(s) *1-15,21-29 and 42-49* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/08/2010*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. This communication is responsive to amended application filed on 09/07/2010.

2. New claim 49 is added. Claims 13, 14, 22, 25, 27, and 28 are amended. Claims 1-49 are pending.

Response to Arguments

3. Applicant's argument relating to 112 rejection is considered. However, note a new 112 rejection.

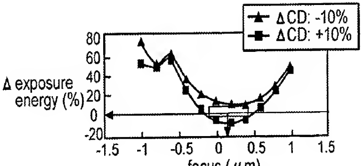
4. Applicant argument relating to art rejection is not persuasive.

a. Applicant argued Miwa et al fails to disclose "building response surface functional relations using the processor of the one or more computing device between variables of lens characteristics and an image profile of interest using the simulation calculation, wherein the response surface functional relations are based on a value of an aberration component" (Remarks, pg. 15 paragraph two).

Examiner respectfully disagrees. Applicant's specification states:

> "A response surface functional relation is built between selected variables of the lens characteristics, in particular the lens aberration components, and the Image Profile using the simulation calculations. Evaluation is then performed on the arbitrary specified aberration values of a lens in relation to the response surface functional relations to provide a calculated estimate of the Image Profile for the specified aberration values" (Abstract).

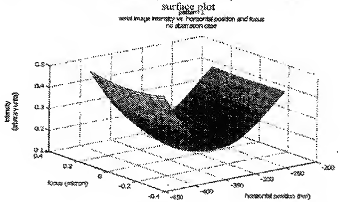
In light of applicant specification, Fig. 5 and Fig. 6 clearly read on the claimed invention. The response surface built with two selected variables such as exposure energy, focus with third order spherical aberration.



(2) with third-order spherical aberration; for 0.05 λ

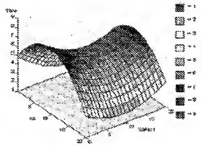
Further,

fig 2 aerial image intensity vs. horizontal position and focus
surface plot

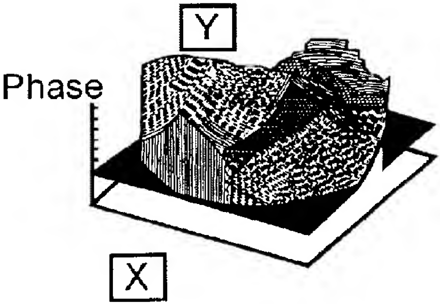


›ther example, http://www.pqsystems.com/products/sixsigma/DOEpack/E
a response surface as follows:

Response Surface for Time



Compare to Fig. 6:

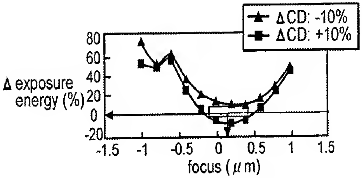


b. Applicant argued, Miwa et al fails to disclose "calculating an image profile using specified aberration values of a lens in conjunction with the response functional relations" (Remarks, pg. 20, paragraph two).

Examiner respectfully disagrees. Applicant's specification states:

> [0060] In other words, a direct mathematical relationship is developed connecting the input values of the aberration coefficients and the resulting image profile shape or plot. These set-up image simulations are executed for any specific pattern and illumination distribution which is desired to be used as a judgment or optimization metric during the lens adjustment process. In effect, the image profile itself in the absence of all aberrations is considered to be the basis image profile, and can be thought of in the form of a plot of optical energy (e.g., amplitude or intensity) versus position, as shown in FIG. 1a."

In light of applicant specification, Fig. 5 is an example plot of image profile as a function of exposure energy value, focus value and aberration value.



(2) with third-order spherical aberration; for 0.05 λ

c. Applicant's argued the limitation of claim 15 is not disclosed in prior art.

Examiner respectfully disagrees. Fig. 5 is an example plot of image profile calculation as a function of exposure energy value, focus value and aberration value and therefore simulation calculation is performed.

As indicated in previous office action, the limitation "calculating the image profile is performed **without** performing a full simulation calculation each and every time new specified aberration values are provided and presented for calculation of a new image profile" is generally not accorded any patentable weight because it has no patentable significance unless a new and unexpected result is produced. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In this case, the prior art discloses calculating the image profile as seen in Fig. 5 shown above.

d. Applicant's argued the limitation of claim 27 is not disclosed in prior art.

Examiner respectfully disagrees. Seltmann et al discloses calculating the fitting function by linear regression which is equivalent to linear equation of the claimed invention. Further, Fig. 4 and Fig. 5 clearly show the linear relationship of the fitting function using the regression equation.

e. Applicant's argument relating to 103 art rejection is not persuasive. Applicants argued that no proper combination of the applied art teaches or suggests each and every features of the claimed invention.

Examiner respectfully disagrees. As stated in pervious office action, Miwa et al does not expressly disclose fitted coefficients values using the response surface functional relations.

Seltmann et al discloses fitted coefficients values using the response surface functional relations (such as "calculate a fit function E(x) by linear regression, least square fit or any higher order fit"; See :Col. 4 lines 18-24).

It would have been obvious to one of ordinary skill in the art to combine the teaching of Seltmann et al with the teaching of Miwa et al because both references are drawn to lithography for semiconductor manufacturing. The motivation to include the fitting function of Seltmann et al to the exposure system of Miwa et al would be to compensate for exposure system error to reduce CD distribution (See: Seltmann et al).

f. Applicants argued "Lee does not cure the deficiencies of Miwa with respect to claim 42 because Lee does not teach or suggest disclose: (i) means

for building response surface functional relations between variables of lens characteristics associated with the image configuration characteristic data using the simulation calculations, wherein the response surface functional relations are based on a value of an aberration component; or (ii) means for calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations. Nor has examiner relied on Lee to teach these features. Instead, the Examiner relied on Lee for a teaching of linear motor. As such, the applied are does not teach the combination of features recited in independent claims 42" (Remarks, pg. 27 last paragraph and pg. 28 first and second paragraphs).

Examiner respectfully disagrees. Applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. As applicant indicated in their argument, the Examiner relied on Lee for a teaching of linear motor which have not disclosed in Miwa et al.

It would have been obvious to one of ordinary skill in the art to combine the teaching of Lee et al with the teaching of Miwa et al because both references are drawn to lithography system. The motivation to include a linear motor of Lee et al with the system of Miwa et al would be to move and align the object stage in a given direction (See: Lee et al).

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 49 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- It recites “calculating step is performed”. However, it is unclear which “calculating step” is referenced (there are two).
- It recites “calculating the image profile are built prior to the image profile being calculated”. It is unclear what does the recited limitation mean? How is this possible? It seems it disables the first calculating step, or else there are two sets of calculated data.
- It fails to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

7. Claim 49 is not examined with respect to art. The reason is:

MPEP section 2143.03 addresses:

> In re Steele, 305 F.2d 859,134 USPQ 292 (CCPA 1962) (**it is improper to rely on speculative assumptions regarding the meaning of a claim and then base a rejection under 35 U.S.C. 103 on these assumptions**).

It is impossible to determine the metes and bounds of the claim.

MPEP section 2173.06 (Prior Art Rejection of Claim Rejected as Indefinite) addresses the issue of applying prior art against such claims:

> … ***Second, where there is a great deal of confusion and uncertainty as to the proper interpretation of the***

> ***limitations of a claim, it would not be proper to reject such a claim on the basis of prior art.*** As stated in In re Steele, 305 F.2d 859, 134 USPQ 292 (CCPA 1962), a rejection under 35 U.S.C. 103 should not be based on considerable speculation about the meaning of terms employed in a claim or assumptions that must be made as to the scope of the claims. The first approach is recommended from an examination standpoint because it avoids piecemeal examination in the event that the examiner's 35 U.S.C. 112, second paragraph rejection is not affirmed, and may give applicant a better appreciation for relevant prior art if the claims are redrafted to avoid the 35 U.S.C. 112, second paragraph rejection.

There is a great deal of confusion and uncertainty as to the proper interpretation of the limitations of the claims for the reasons provided earlier. Thus, it would not be proper to reject such claim on the basis of prior art.

Claim Interpretation

8. As per Claim 15, the limitation of "calculating the image profile is performed without performing a full simulation calculation each and every time new specified aberration values are provided and presented for calculation of a new image profile" is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

10. Claims 1-6, 9-13, 15, 21-26, and 46-48 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent No. 6, 653, 032 issued to Miwa et al.

a. As per Claim 1, Miwa et al discloses a method of calculating estimated image profiles implemented on a tangibly-embodied storage medium resident on one or more computing devices, comprising the steps of:

providing imaging configuration characteristic data (such as "aberration information, process specification information"; See: Col. 4 lines 1-23);

performing simulation calculations for various levels for each aberration component using the imaging configuration characteristic data using a processor of the one or more computing devices (such as "the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 simulation calculation with aberration);

building response surface functional relations using the processor of the one or more computing devices between variables of lens characteristics and an image profile of interest using the simulation calculations (such as "difference between the exposure devices, such as differences in the aberration of the projection lenses, so that the response surface function have to be produced and corrected for each exposure devices"; (See: Col. 3 lines 19-23), Fig. 5 also shows the response surface function of exposure energy and the focus offset due to different aberration of the projection lenses), wherein the response surface functional relations are based on a value of an aberration component

(See: Fig. 5 shows the response surface functional relation between exposure energy and the focus offset due to a third order spherical aberration).

calculating an image profile using specified aberration values of a lens in conjunction with the response surface functional relations using the processor of the one or more computing devices (Fig. 5 shows the set of data sample points are representing the calculation between exposure energy vs. focus offset (i.e. image profiles) within a range of (+/-) 10 with specified aberration (i.e. 0.05) in conjunction with the response).

b. As per Claim 2, Miwa et al discloses the method of claim 1, wherein the image profiles which result as part of the evaluating step are used as measures of relative lens adjustment goodness in an iterative lens adjustment optimization routine (such as "the fluctuation of the exposure energy and the focus offset due to different aberration, the exposure device has to be corrected with aberration 0.05, by an offset of 0.2"; See: Col. 6 lines 60-67).

c. As per Claim 3, Miwa et al discloses the method of claim 1, wherein the imaging configuration characteristic data includes lens data, illumination data and pattern data (See: Fig. 5 the exposure energy and focus offset data's).

d. As per Claim 4, Miwa et al discloses the method of claim 3, wherein:
the illumination data includes at least one of illumination distribution and illumination wavelength, the lens data includes at least one of lens aberration, numerical aperture, pupil filters and lens configuration; and the pattern data

includes object (reticle pattern) layout (such as "process specification database"; See: Col. 6 lines 6-21).

e. As per Claim 5, Miwa et al discloses the method of claim 4, wherein the imaging configuration characteristic data further includes at least one of pattern bias characteristic information and lens focus (such as "process specification database"; See: Col. 6 lines 6-21).

f. As per Claim 6, Miwa et al discloses the method of claim 1, wherein the simulation calculations are executed for various levels of each aberration component (such as "the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).

g. As per Claim 9, Miwa et al discloses the method of claim 1, wherein the response surface functional relations correspond to a sample set of lens characteristics with a final output from application of response surface functional relations being an image profile under the influence of lens aberrations (See: Fig.5, graphical representation of response surface between exposure energy vs. focus offset of (+/-) of 10 with specified aberration of 0.05).

h. As per Claim 10, Miwa et al discloses the method of claim 9, wherein the data configuration characteristic information includes lens characteristics related to variation in single aberration values alone or in combination with one another or with selected items from among the lens characteristics (such as "the exposure energy and the focus offset due to different aberration of the projection

lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).

i. As per Claim 11, Miwa et al discloses the method of claim 1, wherein the response surface functional relations are related to a look-up table summarizing the results of interpolating the image profile generated by the simulation calculations of the performing step (such as "calculation results for the exposure device, reticle, exposure energy and focus offset"; See: Col. 10 lines 19-22, Fig. 9).

j. As per Claim 12, Miwa et al discloses the method of claim 11, wherein the look-up table is direct simulation image profile results or of functional coefficients used to calculate the image profile (such as "calculation results for the exposure device, reticle, exposure energy and focus offset"; See: Col. 10 lines 19-22, Fig. 9).

k. As per Claim 13, Miwa et al discloses the method of claim 11, wherein the calculating step includes determining image profile data points using the look-up table to provide a new image profile associated with specified aberration values (such as "calculation results for the exposure device, reticle, exposure energy and focus offset of steps 207 and 208 of Fig. 8"; See: Col. 10 lines 19-22, Fig. 9).

l. As per Claim 15, Miwa et al discloses the method of claim 1, wherein the performing simulation calculations for various levels for each aberration component comprises performing a full simulation calculation and the calculating the image profile is performed without performing a full simulation calculation

each and every time new specified aberration values are provided and presented for calculation of a new image profile (such as "the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).

m. As per Claim 21, Miwa et al discloses the method of claim 1, wherein each different aberration value applied during the performing step leads to one full image simulation calculation (such as "the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).

n. As per Claim 22, Miwa et al discloses the method of claim 1, wherein the calculating step provides one output image profile for each one set of specified input aberration values (such as "the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).

o. As per Claim 23, Miwa et al discloses the method of claim 1, wherein the response surface function relations are built relating any of variables: (i) position within a specified image plane, (ii) intensity or amplitude, (iii) focus, and (iv) all component aberration levels (such as "the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).

p. As per Claim 24, Miwa et al discloses the method of claim 1, wherein the performing step includes the steps of:

defining a simulation pixel as a unit of horizontal or vertical, position into which an aerial image is divided (such as “the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).;

calculating aerial image amplitude or intensity on each simulation pixel (such as “the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).; and

executing the calculations at defocus positions to provide image profile data including focus response (such as “the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).

q. As per Claim 25, Miwa et al discloses the method of claim 1, wherein the calculating step includes summing an impact from all specified aberration values or combinations of values defined as aberration coefficients for image profile reconstruction (such as “the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration).

r. As per Claim 26, Miwa et al discloses the method of claim 25, wherein the summing step provides an output of intensity or amplitude vs. at least one of

position and focus for the specified aberration values which are an arbitrary set of aberration values (See: Fig. 5 exposure energy vs. focus offset).

s. As per Claims 46-48, the instant claim(s) recite(s) substantially same limitation as the above rejected claim(s) 1-2, and therefore rejected under the same rationale.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. Claims 7, 8, 14, and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6, 653, 032 issued to Miwa et al as applied to claims above, and further in view of US Patent No. 6, 493, 063 issued to Seltmann et al.

a. As per Claim 7, Miwa et al discloses producing a response surface function (See: Col. 2 lines 51-56).

However, Miwa et al does not expressly disclose fitted coefficients values using the response surface functional relations.

Seltmann et al discloses fitted coefficients values using the response surface functional relations (such as "calculate a fit function E(x) by linear regression, least square fit or any higher order fit"; See :Col. 4 lines 18-24).

It would have been obvious to one of ordinary skill in the art to combine the teaching of Seltmann et al with the teaching of Miwa et al because both references are drawn to lithography for semiconductor manufacturing. The motivation to include the fitting function of Seltmann et al to the exposure system of Miwa et al would be to compensate for exposure system error to reduce CD distribution (See: Seltmann et al).

b. As per Claim 8, Seltmann et al discloses the method of claim 1, further comprising the step of generating a new set of aberration components impact upon image profile coefficient values using interpolative methods using the response surface functional relations using the processor of the one or more computing devices (such as "calculate a fit function E(x) by linear regression, least square fit or any higher order fit"; See : Col. 4 lines 18-24; also "fit curve of Fig 4).

c. As per Claim 14, Seltmann et al discloses the method of claim 1, wherein the calculating step includes applying interpolated data of the built response surface functional relations to calculate the image profile for specified aberration values (See: Fit curve of Fig. 4).

d. As per Claim 27, Seltmann et al discloses the method of claim 1, wherein the calculating step is performed using a linear equation using fixed functions with coefficients determined in the building step ("linear regression"; see: col. 4 lines 18-24).

e. As per Claim 28, Seltmann et al discloses the method of claim 1, wherein the building and calculating steps are performed using a sinusoidal fitting function (See: Fit curve of Fig. 4).

f. As per Claim 29, Seltmann et al does not expressly disclose applying a Fourier Transformation or Fast Fourier Transform algorithm intended to estimate a Fourier Transformation process. However, Seltmann discloses a linear regression analysis which is inherently includes Fourier transformation process because a Fourier technique is a form of multiple regression analysis.

13. Claims 42-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6, 653, 032 issued to Miwa et al in view of US Patent No. 5, 528, 118 issued to Lee et al.

a. As per Claim 42, Miwa et al discloses an exposure apparatus, comprising:

an illumination system that projects radiant energy through a mask pattern on a reticle R that is supported by and scanned using a wafer positioning stage (See: Fig. 3 optical projection system, reticle, lense, wafer and wafer stage);

a system for providing optimal image profiling (such as "exposure energy vs. focus offset (i.e. image profiles)"), including:

means for providing image configuration characteristic data (such as “aberration information, process specification information"; See: Col. 4 lines 1-23);

means for performing simulation calculations for various levels for each aberration component using the image configuration characteristic data (such as “the exposure energy and the focus offset due to different aberration of the projection lenses as simulated with an optical development simulator"; See: Col. 6 lines 60-67, Fig. 5 with aberration);

means for building response surface functional relations between variables of lens characteristics associated with the image configuration characteristic data using the simulation calculations (such as "difference between the exposure devices, such as differences in the aberration of the projection lenses, so that the response surface function have to be produced and corrected for each exposure devices"; (See: Col. 3 lines 19-23), wherein the response surface functional relations are based on a value of an aberration component (See: Fig. 5 shows the response surface functional relation between exposure energy and the focus offset due to a third order spherical aberration); and

means for calculating image profile estimates for specified aberration values of a lens by evaluating the specified aberration values in relation to the response surface functional relations (Fig. 5 shows the set of data sample points are representing the calculation between exposure energy vs. focus offset (i.e.

image profiles) within a range of (+/-) 10 with specified aberration (i.e. 0.05) in conjunction with the response).

Miwa et al discloses wafer stage (See: Fig. 3). Miwa et al fails to disclose at least one linear motor that positions the wafer positioning stage.

Lee et al discloses at least one linear motor that positions the wafer positioning stage (such as "a linear motor for aligning the wafer with the lens of the optical system"; See: Col. 3 lines 53-56).

It would have been obvious to one of ordinary skill in the art to combine the teaching of Lee et al with the teaching of Miwa et al because both references are drawn to lithography system. The motivation to include a linear motor of Lee et al with the system of Miwa et al would be to move and align the object stage in a given direction (See: Lee et al).

g. As per Claim 43, Miwa et al discloses the apparatus of claim 42, further comprising means for applying the aberrated image profile estimates in an optimization calculation method which judges image profile information against defined criteria as part of a lens adjustment optimization calculation (such as "calculating the optimum values of the exposure energy and focus offset using the process window for the exposure step"; See: Col. 2 lines 24-26).

h. As per Claim 44, Miwa et al discloses a device manufactured with the exposure apparatus of claim 42 (such as "fabricating semiconductor devices"; See: Col. 1 lines 24-25).

i. As per Claim 45, Miwa et al discloses a wafer on which an image has been formed by the exposure apparatus of claim 42 ("Wafer Stage"; See: Fig. 4).

Allowable Subject Matter

14. Claims 16-20 and 30-41 are allowed over a prior art.

15. The following is a statement of reasons for the indication of allowable subject matter: claims 16-20 and 30-41 are considered allowable since reading the claims in light of the specification, none of the references of record alone or in combination disclose or suggest the combination of limitations specified in the independent claims, specifically:

As per Claim 16, the limitation of "wherein the building steps include: providing a fitting function expressed as:

$$I_{spx}(x) = b_0 + b_1 x + b_2 x^2 + b_3 x^3 + \ldots + b_n x^n$$

where I_{spx} is aerial image intensity or amplitude at a simulation pixel *(spx)* and x indicates defocus; and

expressing a change of the coefficients $b_0 \ldots b_n$ described by an order fitting function expressed as:

$$b_{i(with\_aberration)} = b_{i(w/o\_aberration)} + \sum_{j=2}^{Zn} \Delta b_i(cj)$$

$$= b_{i(w/o\_aberration)} + \sum_{j=2}^{Zn} \varphi_{0(i,j)} + \varphi_{1(i,j)} c_j + \varphi_{2(i,j)} c_j^{\,2} + \varphi_{3(i,j)} c_j^{\,3} + \ldots + \varphi_{n(i,j)} c_j^{\,n}$$

wherein

$i = 0, 1, 2, 3, \ldots, n;$

$b_{i(with\ aberration)}$ and $b_{i(w/o\ aberration)}$ represents one of the coefficients $b_0 \ldots b_n$ influenced by lens aberrations and the coefficients $b_0 \ldots b_n$ without aberrations, respectively, and

Δbi indicates the change in coefficients and is expressed by an n^{th} order fitting function of jth Zernike coefficient c_j,

$\cancel{\Theta_{0(ij)} \ldots \Theta_{n(ij)}}$ $\underline{\varphi_{0(i,j)} \ldots \varphi_{n(i,j)}}$ are the coefficients of the fitting function, determined following the performing step of setup simulations of image profile as a function of regularly iterated values of lens aberration. ".

(as defined in specification page 34 line 15 through page 37 line 23).

As per Claim 30, the limitation of: "building response surface functional relations between variables of the image configuration characteristics and the image profile of interest using the simulation calculations data input to be fit using:

$$I_{spx}(x) = b_0 + b_1 x + b_2 x^2 + b_3 x^3 + \dots + b_n x^n$$

where I_{spx} is aerial image intensity or amplitude at a simulation pixel *(spx)* and x indicates defocus; and

expressing a change of the coefficients $b_0 \dots b_n$ described by an order fitting function expressed as:

$$b_{i(with\_aberration)} = b_{i(w/o\_aberration)} + \sum_{j=2}^{Zn} \Delta b_i(cj)$$

$$= b_{i(w/o\_aberration)} + \sum_{j=2}^{Zn} \varphi_{0(i,j)} + \varphi_{1(i,j)} c_j + \varphi_{2(i,j)} c_j^{\ 2} + \varphi_{3(i,j)} c_j^{\ 3} + \dots + \varphi_{n(i,j)} c_j^{\ n}$$

wherein

$i = 0, 1, 2, 3, \dots, n$;

$b_{i(with\ aberration)}$ and $b_{i(w/o\ aberration)}$ represents one of the coefficients $b_0 \dots b_n$ influenced by lens aberrations and the coefficients $b_0 \dots b_n$ without aberrations, respectively, and

Δbi indicates the change in coefficients and is expressed by an n^{th} order fitting function of *j*th Zernike coefficient c_j,

~~$\Theta_{0(ij)} \dots \Theta_{n(ij)}$~~ $\varphi_{0(i,j)} \dots \varphi_{n(i,j)}$ are the coefficients of the fitting function, determined following the performing step of setup simulations of image profile as a function of regularly iterated values of lens aberration. " (as defined in specification page 34 line 15 through page 37 line 23).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KIBROM GEBRESILASSIE whose telephone number is (571)272-8571. The examiner can normally be reached on Monday-Friday 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571)272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KIBROM GEBRESILASSIE/
Examiner, Art Unit 2128

/Hugh Jones/
Primary Examiner, Art Unit 2128